CLAIMS

We claim:

1. A composition comprising a matrix of one or more catalytic components and at least one olefin-based material, wherein the catalyst component is an organometallic complex selected from the group consisting of Group 3-10 metals, non-metals, lanthanide metals, actinide metals and combinations thereof; the olefin-based material further comprising an organic material having a plurality of free olefin groups; and wherein the matrix is formed by reaction of the catalytic component and the free olefin groups of the olefin-based material.

2. ~~The composition of claim 1, wherein the olefin-based material is a macroporous polymer prepared in the presence of a porogen and is selected from the group consisting of divinylbenzene polymers, divinylbenzene copolymers, styrene/divinylbenzene copolymers, divinylbenzene resins, cross-linked divinylbenzene polymers, styrene/butadiene copolymers, styrene/isoprene copolymers, vinylsiloxane polymers, alkylalumoxanes, alkylsiloxanes and combinations thereof; and wherein the free olefin groups are optionally disposed on the surface of the olefin-based material.~~

3. The composition of claim 1, wherein the olefin based material is prepared by incorporating a plurality of free olefin groups into a solid selected from the group consisting of silica, silica polymorphs, alumina, alumina polymorphs, magnesia, magnesia polymorphs, siloxanes, alumoxanes, alkylalumoxanes, alkylsiloxanes, aluminosilicates, clays, zeolites and combinations thereof; the olefin-based material optionally having the free olefin groups disposed on the surface of the solid.

4. The composition of claim 1, wherein the catalytic component is selected from the group consisting of olefin polymerization catalysts, Ziegler-Natta catalysts, metallocene complexes of Group 3-10 metals, metallocene complexes of non-metals, metallocene complexes of lanthanide metals, metallocene complexes of actinide metals, single-site catalysts, single site metallocene catalysts, and combinations thereof; and wherein the matrix further comprises a plurality of catalytic components, at least one activator

component and is used for polymerizing at least one olefin monomer selected from the group consisting of unbranched aliphatic olefins having from 2 to 12 carbon atoms, branched aliphatic olefins having from 4 to 12 carbon atoms, unbranched and branched aliphatic α-olefins having from 2 to 12 carbon atoms, conjugated olefins having 4 to 12 carbon atoms, aromatic olefins having from 8 to 20 carbons, unbranched and branched cycloolefins having 3 to 12 carbon atoms, unbranched and branched acetylenes having 2 to 12 carbon atoms, and combinations thereof..

5. The composition of claim 1, wherein the matrix is represented by a formula $[Cp^1Cp^2MR_xL]^+ [NCA]^-$, wherein M is a Group 4 metal, Cp^1 is a substituted or non-substituted cyclopentadienyl ring and Cp^2 is the same or different, substituted or non-substituted cyclopentadienyl ring and may be bridged symmetrically or asymmetrically to Cp^1, R is hydride, alkyl, silyl, germyl or an aryl group, x is an integer equal to 0 or 1, L is an olefin-based material and NCA is a non-coordinating anion; or the matrix is represented by a formula $[Cp^1Cp^2MR]^+ [NCA]^-$, wherein M is a Group 4 metal, Cp^1 is a substituted or non-substituted cyclopentadienyl ring and Cp^2 is the same or different, substituted or non-substituted cyclopentadienyl ring and may be bridged symmetrically or asymmetrically to Cp^1, R is a hydrocarbyl group derived from the hydrozirconation of an olefin-based material and NCA is a non-coordinating anion; or the matrix is represented by a formula $[Cp^1MR_xL]^+ [NCA]^-$, wherein M is a Group 4 or 6 metal, Cp^1 is a substituted or non-substituted cyclopentadienyl ring, R is a hydride, alkyl, silyl, germyl or an aryl group, x is an integer ranging from 0 to 6, L is an olefin-based material and NCA is a non-coordinating anion; or the matrix is represented by a formula $[(\text{Multidentate})\ MR_xL]^+ [NCA]^-$, wherein M is a Group 4 or 6 or 8 or 9 or 10 metal, R is hydride, alkyl, silyl, germyl, aryl, halide or alkoxide group, x is an integer equal to 0, 1 or 2, multidenate is a bidentate, tridentate or tetradentate ligand containing nitrogen, sulfur, phosphorus and / or oxygen as coordinating atoms to the metal, L is an olefin-based material and NCA is a non-coordinating anion; or the matrix is represented by a formula $(\text{Multidentate})\ MR_xL$, wherein M is a Group 4 or 6 or 8 or 9 or 10 metal, R is hydride, alkyl, silyl, germyl, aryl, halide or alkoxide group, x is an integer equal to 0, 1 or 2, multidenate is a bidentate, tridentate or tetradentate ligand containing nitrogen, sulfur, phosphorus and / or oxygen as coordinating atoms to the metal and L is an olefin-based material; or the matrix is

represented by a formula $(Cp^1)_x(Cp^2)_yMR_xL+[NCA]^-$, wherein M is a lanthanide or an actinide metal, R is hydride, alkyl, silyl, germyl, aryl, halide, alkoxide, amide or solvent ligand, R may also be a bidentate ligand containing nitrogen, sulfur, phosphorus and / or oxygen, x = 0-2, y = 0-2, L is an olefin-based material and NCA is a non-coordinating anion.

6. The composition of claim 1, wherein the matrix is prepared from olefin-based materials having particle diameters ranging from 5 nm to 1000 μm.

7. An olefin polymerization process that comprises the steps of contacting at least one olefin monomer and a composition comprising a matrix of one or more catalytic components and at least one olefin-based material, wherein the catalyst component is is an organometallic complex selected from the group consisting of Group 3-10 metals, non-metals, lanthanide metals, actinide metals and combinations thereof, the olefin-based material further comprising an organic material having a plurality of free olefin groups and wherein the matrix is formed by reaction of the catalytic component and the free olefin groups of the oelfin-based material; and polymerizing the olefin monomer to produce a polyolefin.

8. The process according to claim 7, wherein the olefin monomer is selected from the group consisting of unbranched aliphatic olefins having from 2 to 12 carbon atoms, branched aliphatic olefins having from 4 to 12 carbon atoms, unbranched and branched aliphatic α-olefins having from 2 to 12 carbon atoms, conjugated olefins having 4 to 12 carbon atoms, aromatic olefins having from 8 to 20 carbons, unbranched and branched cycloolefins having 3 to 12 carbon atoms, unbranched and branched acetylenes having 2 to 12 carbon atoms, and combinations thereof; and wherein the olefin monomer is a polar olefin monomer having from 2 to 12 carbon atoms and at least one atom selected from the group consisting of O, N, B, Al, S, P, Si, F, Cl, Br and combinations thereof.

9. The process according to claim 7, wherein the olefin monomer is selected from the group consisting of ethylene, propene, 1-butene, 1-hexene, butadiene, styrene, alpha-

methylstyrene, cyclopentene, cyclohexene, cyclohexadiene, norbornene, norbornadiene, cyclooctadiene, divinylbenzene, trivinylbenzene, acetylene, diacetylene, alkynylbenzene, dialkynylbenzene, ethylene/1-butene, ethylene/isoprene, ethylene/1-hexene, ethylene/1-octene, ethylene/cyclopentene, ethylene/cyclohexene, ethylene/butadiene, ethylene/hexadiene, ethylene/styrene, ethylene/acetylene, propene/1-butene, propene/styrene, propene/butadiene, propene/1,6-hexadiene, propene/acetylene, ethylene/propene/1-butene, ethylene/propene/1-hexene, ethylene/propene/1-octene, and combinations thereof.

10. The process according to claim 7, wherein the polymerization is selected from the group consisting of a copolymerization of ethylene and higher α-olefins, a copolymerization of propene and higher α-olefins, and a copolymerization of styrene and higher α-olefins.

11. The process according to claim 7, wherein the polyolefin produced is selected from the group consisting of HDPE, LDPE, LLDPE, polyolefins incorporating a plurality of olefin monomers, polyolefins incorporating α-olefins, copolymers of ethylene and α-olefins selected from the group consisting of 1-butene, 1-hexene and 1-octene, stereospecific polyolefins, stereoregular polyolefins, and polyolefins having stereospecific structures selected from the group consisting of atactic, isotactic, syndiotactic, hemi-isotactic and stereoregular blocks and combinations thereof.

12. The process according to claim 7, wherein a polyolefin particle essentially retains the shape of a prepared matrix particle.

13. The process according to claim 7, wherein the catalytic component is selected from the group consisting of olefin polymerization catalysts, Ziegler-Natta catalysts, metallocene complexes of Group 3-10 metals, metallocene complexes of non-metals, metallocene complexes of lanthanide metals, metallocene complexes of actinide metals, single-site catalysts, single site metallocene catalyst and combinations thereof; wherein the matrix further comprises a plurality of catalytic components and at least one activator component; and wherein the matrix is represented by a formula $[Cp^1Cp^2MR_xL]^+ [NCA]^-$, wherein M is a Group 4 metal, Cp^1 is a substituted or non-substituted cyclopentadienyl

ring and Cp^2 is the same or different, substituted or non-substituted cyclopentadienyl ring and may be bridged symmetrically or asymmetrically to Cp^1, R is hydride, alkyl, silyl, germyl or an aryl group, x is an integer equal to 0 or 1, L is an olefin-based material and NCA is a non-coordinating anion; or the matrix is represented by a formula $[Cp^1Cp^2MR]^+$ $[NCA]^-$, wherein M is a Group 4 metal, Cp^1 is a substituted or non-substituted cyclopentadienyl ring and Cp^2 is the same or different, substituted or non-substituted cyclopentadienyl ring and may be bridged symmetrically or asymmetrically to Cp^1, R is a hydrocarbyl group derived from the hydrozirconation of an olefin-based material and NCA is a non-coordinating anion; or the matrix is represented by a formula $[Cp^1MR_xL]^+$ $[NCA]^-$, wherein M is a Group 4 or 6 metal, Cp^1 is a substituted or non-substituted cyclopentadienyl ring, R is a hydride, alkyl, silyl, germyl or an aryl group, x is an integer ranging from 0 to 6, L is an olefin- based material and NCA is a non-coordinating anion; or the matrix is represented by a formula $[(\text{Multidentate})\ MR_xL]^+$ $[NCA]^-$, wherein M is a Group 4 or 6 or 8 or 9 or 10 metal, R is hydride, alkyl, silyl, germyl, aryl, halide or alkoxide group, x is an integer equal to 0, 1 or 2, multidenate is a bidentate, tridentate or tetradentate ligand containing nitrogen, sulfur, phosphorus and / or oxygen as coordinating atoms to the metal, L is an olefin-based material and NCA is a non-coordinating anion; or the matrix is represented by a formula (Multidentate) MR_xL, wherein M is a Group 4 or 6 or 8 or 9 or 10 metal, R is hydride, alkyl, silyl, germyl, aryl, halide or alkoxide group, x is an integer equal to 0, 1 or 2, multidenate is a bidentate, tridentate or tetradentate ligand containing nitrogen, sulfur, phosphorus and / or oxygen as coordinating atoms to the metal and L is an olefin-based material; or the matrix is represented by a formula $(Cp^1)_x(Cp^2)_yMR_xL+[NCA]^-$, wherein M is a lanthanide or an actinide metal, R is hydride, alkyl, silyl, germyl, aryl, halide, alkoxide, amide or solvent ligand, R may also be a bidentate ligand containing nitrogen, sulfur, phosphorus and / or oxygen, x = 0-2, y = 0-2, L is an olefin-based material and NCA is a non-coordinating anion.

14. The process according to claim 7, wherein the polyolefin is prepared in a reactor system selected from the group consisting of gas phase reactors, slurry phase reactors and solution phase reactors and combinations thereof.

15. A coating process comprising depositing the matrix of claim 1 on a substrate and polymerizing olefin monomer to produce a polyolefin coated surface, object or particulate.

16. The process according to claim 15, wherein the substrate is selected from the group consisting of clays, micas, silicates, metals, polymer paticles, non-metal oxides, organometallic oxides and inorganic oxides.

17. A process for preparing a composite of substrate and polyolefin in-situ using the matrix of claim 1 in combination with at least one substrate.

18. A process according to claim 17, wherein the substrate is selected from the group consisting of clays, micas, silicates, metals, polymer particles, non-metal oxides, organometallic oxides and inorganic oxides.

19. A process according to claim 17, wherein polyolefin properties are modified.

~~20. A process for the production of hydrophobically modified particles in the form of spheres, surfaces and objects in which the catalytic matrix is disposed on the surfaces thereof.~~